GSAS v4.1 Release Notes
GSAS Team
December 16, 2004

Introduction

GSAS Release 4.1 introduces significant improvements in the software. 45 PR/CRs were resolved by this release.

For L1A, the following changes were made:

- Implemented a 1-shot gain shift algorithm which should improve energy-related parameters.

- Implemented sanity checking algorithm which flags ANC32 files that do not contain valid GSP latches.

- Changed spare bits from 1 to 0 in the Instrument State flag.

- Fixed multiple problems involving the energy computation.

For Waveforms, the following changes were made:

- Improved alternate fit for a specific case of waveforms.

- Added new LPA orientation parameters to waveform and elevation products.

For Elevation, the following changes were made:

- Improved calculation of sea ice roughness parameters and added new sea ice parameters to elevation products.

For Atmosphere, the following changes were made:

- Added along-track QA and browse capabilities for atmosphere products.

- Added surface type flag to atmosphere products.

- Improved aerosol/cloud discrimination and layer detection.

Other, more general fixes include:

- Updated ANC45 versionID and parameter names.

- Removed Instrument State parameters from metadata.

- Continued general code cleanup.

- Made significant improvements to QA processing and browse products.

- Improved product database documentation.

- Added additional parameters to products (see product change section for details).

Please refer to the attached documents "Revised Alternate Waveform Fitting Release Notes for Release 19" and "Level 2 Sea Ice Product – GLA13" for more specific changes regarding relevant improvements in this release.

Product Format/Definition Change Summary

GLA01-04:

    i_GainShiftFlg : added to GLA01, partially replacing spare2.

    i_inst_state : spares changed from 1 to 0 (reflects throughout rest of products).

    i_boxX : updated description on GLA04_01.

    i_boxY : updated description on GLA04_01.

    i_PixInt : updated description on GLA04_01.

    i_T0_SA : updated description on GLA04_02.

    i_lrs_RawRow : updated description on GLA04_02.

    i_lrs_RawCol : updated description on GLA04_02.

    i_VTCentR : updated description on GLA04_02.

    i_VTCentC : updated description on GLA04_02.

GLA05:

    i_parm1 : changed units to 0.0001 volts, 6*(0.0001 volts, 0.01 ns, 0.01 ns)

    i_parm1 : changed min values to -30, 6*(0, -100000, 0)

    i_parm1 : changed max values to 30000, 6*(30000, 0, 32766)

    i_parm2 : changed units to 0.0001 volts, 6*(0.0001 volts, 0.01 ns, 0.01 ns)

    i_parm2 : changed min values to -30, 6*(0, -100000, 0)

    i_parm2 : changed max values to 30000, 6*(30000, 0, 32766)

    i_solnSigmas1 : changed units to 0.0001 volts, 6*(0.0001 volts, 0.001 ns, 0.001 ns); max values to 30000, 6*(30000, 3000, 3000).

    i_solnSigmas2 : changed units to 0.0001 volts, 6*(0.0001 volts, 0.001 ns, 0.001 ns); max values to 30000, 6*(30000, 3000, 3000).

    i_parmTr : changed max to 30000, 30000, 4800, 32766.

    i_PODFixedPos : changed units to 3*(m,mm)

    i_tpCentX : added, replacing spare7.

    i_tpCentY : added, replacing spare8.

    i_tpOrX : added, replacing spare2.

    i_RMSpulseWd : added, partially replacing spare6.

GLA07-11:

    i_cld1_mswf : updated documentation on GLA11.

    i_cld1_od : updated units to unitless*1000 on GLA11.

    i_aer4_od : updated units to unitless*1000 on GLA11.

i_pbl4_od : updated units to unitless*1000 on GLA11.

i_surfType : added, partially replacing spare1.

GLA06, 12-15:

i_cld1_mswf : updated documentation.

i_reflCor_atm : updated name and description.

i_AvgElev : removed from GLA13.

i_SiRufMaxPk : added, replacing i_AvgElev and spare7 on GLA13.

The latest product formats/descriptions will be available at http://wffglas.wff.nasa.gov/v41_products/.

Known Problems

More improvements may be needed in sea ice roughness calculations. Validity of the additional parameter needs to be verified.

532 background in daylight conditions is not being computed properly.

Area fit of saturated waveforms still being investigated.

i_reflCor_atm is corrected only for the molecular optical depth; not for cloud and aerosol effects.

Laser transmitted energy calcuation is incorrect.

40 Hz cloud layer height generation need improvement.

40 Hz cloud heights from the 1064 channel not implemented.

Need to replace estimated atmospheric transmissivity with actual in reflectivity calculation.

GLA02 browse product is not available.

GLA16 (HDF Level 3 product) not supported.

Release Information

The ClearCase label for this release is RELEASE_4.1.

Products generated by this software will be labelled as Release 19 by SDMS.

The release date is December 10, 2004.

Version numbers have been updated to "V4.1 November 2004" for the following:

- all libraries
- GLAS_L0proc
- GLAS_L1A
- GLAS_Alt
- GLAS_Atm

- GLAS_Meta
- ANC07
- ANC45

This should be verified during operation by checking the version information in the appropriate ANC06 files.

SMDS Impact

The distribution tarfile is on glasdev.wff.nasa.gov at the following location:

```
/glasdev1/v4/dist/gsas_V4.1.tar.Z.
```

ANC Files

New versions of the ANC07 and ANC45 data files are required.

The updated ANC33 file provided with the distribution should be ingested and used.

Bundle Changes

Start and Stop times are now required for granules specified in the QAPG control files.

ANC27 is now a required input for atmosphere processing.

For Browse jobs, the control file version keyword should be changed to reflect version 4.2. eg: VERSION=4.2

Compilation

All libraries and binaries should be recompiled using the top-level Makefile.

The process for making the libraries and binaries is as follows **(NOTE: SDMS ONLY!!)**

```
cd /install_dir/gsas_v4.1
make runtime
make install
```

Note : developers should not use the above procedure. This procedure is for SDMS only!

Detailed Change Notes

0001820: Problem generating QAP07 files for multi-file run

Bug was corrected which allowed multiple QAP07 files to be generated in a single GLAS_Atm processing run.

0001816: QAP03 browse jobs fail

Fixed bug in browse code so it will generate GLA03 browse products.

0001815: GLAS_Atm overflow for QAP09

A check was added to avoid using an invalid value as an input to averaging of ground height.

0001814: Energy Computation Is Wrong For Compressed WFs

The compression for NPQ type compression was being used backwards. This has been corrected. Energy was being calculated only from the area under the waveform above the noise. This has been changed by subtracting the area below the observed noise above the waveform in order to remove the contribution incorrectly calculated from the noise.

0001810: The Documentation For GLA05 Needs To Be Changed

i_parm1 : changed units to 0.0001 volts, 6*(0.0001 volts, 0.01 ns, 0.01 ns)

i_parm1 : changed min values to -30, 6*(0, -100000, 0)

i_parm1 : changed max values to 30000, 6*(30000, 0, 32766)

i_parm2 : changed units to 0.0001 volts, 6*(0.0001 volts, 0.01 ns, 0.01 ns)

i_parm2 : changed min values to -30, 6*(0, -100000, 0)

i_parm2 : changed max values to 30000, 6*(30000, 0, 32766)

i_solnSigmas1: changed units to 0.0001 volts, 6*(0.0001 volts, 0.001 ns, 0.001 ns); max values to 30000, 6*(30000, 3000, 3000).

i_solnSigmas2: changed units to 0.0001 volts, 6*(0.0001 volts, 0.001 ns, 0.001 ns); max values to 30000, 6*(30000, 3000, 3000).

i_parmTr : changed max to 30000, 30000, 4800, 32766.

0001806: Tweak to Cloud/Aerosol Discrimination

Lessened the functional dependence of latitude on the cloud-aerosol discrimination threshold levels.

0001797: MSWF documentation needs details

In the product database for GLA11, variable i_cld1_mswf: Added the description of the MSWF. In the description field I added the information listed above. In the PDF of i_cld1_mswf, I added the four bit set of values and the "NOTE" information as listed above. The reason for the piece meal in the Description and the PDF, was that there was not sufficient space in the DESCRIPTION & COMMENT fields to contain all of the information. Database/PDF updated.

0001794: Crash in GLA06 A2P for bad d_SigEndOff

Added checks for invalid values before all computations using data from gla05.

0001783: Waveforms crashes in anc08 module

A rare condition that arises when there is no transmitted pulse at the beginning of a processing run has been corrected.

0001781: ESDTs Rel 19 instrument state

InstrumentState, InstrumentStateDate, and InstrumentStateTime have been removed from all .met files, however, this information remains in the product header. The instrument state additional attributes information has also been changed from mandatory to not mandatory at NSIDC to accomodate file ingest where the metadata does not contain instrument state additional attributes.

0001779: IDL QA issues

Most changes involved program details that do not affect the appearance of the images, but simplify the code or make it somewhat more robust.

Updated COMPILE_OPT statement in all modules that were changed.

Refined setup of bars.

For the qa 7-11 products, the table locations were adjusted.

Titles were added to the color bars on the images for qa 7 and 10.

Tick mark locations corrected on qa 10 images.

Explanatory header added to one of the qa 5 plots.

Char size reduced for postscript output for all plots.

0001771: Overflow condition in GLA10_scal_mod

The GLA10_scal_mod routine was not altered to fix this problem. The location in the code where GLA10%d_cld1_sval2 is computed was located and a limit on its maximum value (327.0) was inserted. This was done in the routines A_opt_thin_mod and A_cld_opt_prop_mod.

These changes were then tested and verified by Steve Mclaughlin and Jack Saba who ran the code on 3+ hours of data.

0001769: bad last record in GLA01

Fixed a problem where read_gla01 did not return immediately after getting an EOF on the main record.

0001767: Update metadata VersionID, VersionDescription
The GLA01-GLA15 .met files have been updated with the latest release 19 information.

0001766: Change metadata contact info
The GLA01-GLA16, and ancillary ESDT descriptor files have been updated with the NASA one e-mail address scheme. New contact information was added for John DiMarzio and Anita Brenner's contact information was removed.

0001765: Optical Density units GLA11

Changed the product units for the following variables in GLA11.
 (changed unitless to unitless*1000)
 i_cld1_od unitless*1000
 i_aer4_od unitless*1000

0001761: GLA06/12-15 Variable i_reflCor_atm Mislabeled

The product database was changed for GLA06/12-15 variable i_reflCor_atm. The name and description were changed per requested change.

0001759: Modify IDL software to work with updated qap files for GLA 7-11

Changed IDL read, browse, and compare code to read, plot, and compare the updated qap07-11 data. Included in this fix is a change to qapc_faillevel.pro which should have been merged with Mantis 1390 but was missed.

0001758: Change QAPG to use new qapxx_mod for GLA 7-11

QAPG was changed to work with the updated qapxx_mod.f90 (xx=07-11) modules. The changes to the qap were made under Mantis 1699.

0001737: Software Problem Report

Fixed initialization errors in CalcQAP13 and CalcQAP15.

0001731: i_rng_UQF (GLA06,12-15) online documentation not consistent with code

Corrected setting of i_RngOffQF in ElevMgr and WFMgr.

0001726: QAP01 % APID 12/13 calculated incorrectly

The percent of waveforms,APID12 and APID13, calculation has been changed to use the total number of waveforms that are present.

0001713: Improve Alternate Fit of Some WFs

Changed W_LsqFit_mod to reset the noise parameter to the estimated value after each iteration. Fixed initialization of d_oldFitSDev in W_FunctionalFt_mod (this variable retained the previous value, so if the alternate fit had a smaller standard deviation of fit than the standard fit, an inappropriate choice would have been made when deciding whether to try a second fit).

0001707: Short anc32 File Sanity

There is a time problem introduced on the GLA products when an ANC32 file contains no valid GPS time latches. Implemented improved sanity checking for ANC32 :

 If number of anc32 records in a file < 2, ignore all data in the file.
 If number of anc32 records available for processing < 2, error out with fatal error code.

Another catch was that the Error Description above failed to specify "good" records. I think the aforementioned error cases actually had more than 2 records in the ANC32 files, but all records but two were flagged as bad data.

0001699: Implement Along-track averaging QA for GLA7-11

The atmosphere products in GLA07 through GLA11 have received a major upgrade to the information that is available in the QAP files that accompany these products. All QA software has been rewritten to conform to GSAS norms for other products, which improves maintainabiity and readability. Summary data has been updated, and an along-track averaging capability has been added to provide periodic status information. Although variable, the default output rate is every 16 seconds or every 100 km of the satellite ground track.

0001696: All Browse 05 jobs are failing (Rel 18)
QABrowse modified to report correct status when processing GLA05 files.

0001681: GLA01 i_inststate spare bits are set but not documented as such

Provided new ANC33 file which has spare bits in instrument state changed from 1 to 0.

0001678: GLAS ATM bombs with integer overflow in gla07_scal_mod

Implemented a fix for a condition where a few bins of a 1064 profile had values that were physically implausible.

0001674: GLA04 LPA, LRS image descriptions need clarification/correction
The following product description changes have been completed to GLA04-01 (LPA).
 i_boxX:: X Coordinate for the top left corner of the 20 by 20 LPA image data, 0 to 79. To map the LPA image into the LRS image the LPA image needs to be rotated 90 degrees clockwide. So the LPA rotated to LRS (column) upper left X corner is 79 minus i_boxY minus 19.
 i_boxY:: Y Coordinate for the top left corner of the 20 by 20 LPA image data, 0 to 79. To map the LPA image into the LRS image the LPA image needs to be rotated 90 degrees clockwide. So the LPA rotated to LRS (row) upper left Y corner is i_boxX.
 i_PixInt:: The forty per second images of the laser pulse. 20x20 box of LPA pixel intensity data. Row 1 column 1 to 20 first, then row 2 to 20. Row is Y and column is X. To map the LPA image into the LRS image the LPA image needs to be rotated 90 degrees clockwise.

The following product description changes have been completed to GLA04-02 (LRS).
 i_T0_SA:: The image will be a 16 X 16 pixel image. The first word (2byte) in the PRAP data contains the frame number. It has been set to the same value as the second pixel so that automatic scaling in plots can work. Order of the data is: row 1 column 1 to 16; row2 column 1 to 16; ....; row 16 column 1 to 16. Column is X and Row is Y.
 i_lrs_RawRow:: Raw row data from LRS SA-2 trackers 0-2, Samples 1-10. Raw Row (Y axis) is the upper left hand corner Y position of the LRS 16x16 image array (i_T0_SA).

i_lrs_RawCol:: Raw column data from LRS SA-2 trackers 0-2, Samples 1-10. Raw column (X axis) is the upper left hand corner X position of the LRS 16x16 image array (i_T0_SA).

i_VTCentR:: Centroid Row from LRS SA-2 Virtual Trackers 0 - 2, Samples 1-10. Row is Y. The row (0 to 15) within the image data (i_T0_SA) is i_VTCentR minus i_lrs_RawRow.

i_VTCentC:: Centroid Column from LRS SA-2 Virtual Trackers 0 - 2, Samples 1-10. Column is X. The column (0 to 15) within the image data (i_T0_SA) is i_VTCentC minus i_lrs_RawCol.

0001672: QAPCompare, QAPRead changes for GLA01 and GLA05 metadata

QAPG changed to write a header record with product-to-algorithm scale factors for all parameters relevant to the calculation of the qap data.

qapread changed to read the additional header record.

qapcompare changed to output correct values for GLA01 and 05 metadata parameters.

0001670: Problems with waveform QA

Changed count of noFit WFs to include only those WFs that have a signal. Added code to make sure that QA records with time=0.0d0 or with no valid data are not written to the QAP file.

0001668: Sea ice roughness parameters not calculated correctly on GLA13

Improved calculation of sea ice roughness parameters and added new sea ice roughness parameters to GLA05 and GLA13. (See product change section).

0001667: QAPG changes for metadata requirements

QAPG was changed to write header record with product-to-algorithm scale factors for all parameters relevant to the calculation of the qap data.

QAPRead was changed to read the additional header record.

iQA100tFrm(gwi_ndx_a) was being double counted. Removed line that was adding giNumWf for every frame. Left line that is adding 1 for each valid waveform.
 - the count of waveforms with signal in both along-track and summary QAP records should be based on the value of the nosignal flag in L_WFQual, because the value of this flag is used to determine if a fit will be attempted.

Changed code to compute a mean value if there is at least one point, set the std dev to invalid for < 2 points, and compute a std dev for at least 2 points.

0001666: QAPG should get requested file times from control file

Mantis 1666 changes QAPG to allow it to read start and end times from the INPUT_FILE and OUTPUT_FILE lines in the control file. Times from the INPUT_FILE

lines are ignored. If times are not present in the control file, they are taken from the first and last valid shots in the input file. These times are used ONLY for products where the start and end times in the summary record of the main QAP file (the one produced by the run that generates the product file) are taken from the control file.

CURRENTLY, TIMES ARE NOT PUT IN THE QAPG CONTROL FILE. THIS WILL REQUIRE A CHANGE IN ISIPS AND SCF PROCEDURES.

0001657: Add LPA orientation parameters to GLA05

Added i_tpCentX, i_tpCentY & i_tpOrX to gla05. Changed

l_WFqual(31,40) to l_WFqual(32,40). Added gwi_spare32 to

const_wf_mod. In anc09_pad_mod, changed Spare1(i*4) to

i_tpCentX(i*2) & i_tpCentY(i*2), and Spare2(r*4) to

i_tpOrX(i*2) & Spare1(i*2).

0001634: Land/Ocean Flag added to Atmosphere Products

The parameter surftype, identical to that currently appearing in products 6 and 12-15, has been added to the atmosphere products 7-11. It provides a flag showing the pre-defined surface type (Land, Seaice, Ocean, or Icesheet) or surface type combinations for every observation. Because of this added functionality, control files for GLAS_Atm must now include the two anc27 files which store the surface type flag values.

0001628: Gain reported is delayed in application

Implemented a 1-shot gain shift which is applied during the following conditions:

1) The delta time between previous and current shot is < 0.3 sec AND
2) The corresponding i_RespEndTime < 4500000 ns

A new flag (i_GainShiftFlg) was added to GLA01. Each of the 40 flags indicates if the corresponding gain measurement was shifted. If the gain was not shifted, the existing gain measurement is used and the corresponding flag set to 1. A flag with value 0 indicates the gain measurement was shifted normally.

0001625: GLA05 browse products: locations reported on along-track scatter plots incorrect

The calculation of latitude and longitudes printed at the start and end of the data on the along-track plots was corrected.

0001403: Merge QAPxx modules with elevation code

Mantis 1403 integrates the elevation qap modules that are being used with QAPG into the elevation code.

0001402: Waveform ATBD change needed

The specification of the meaning of individual bits in the flag words should not be

included in the ATBD. These are documented in the online descriptions, and the ATBD should point to this documentation.

0001390: Elevation QAP changes for metadata

Updates for metadata, especially for the elevation products.

For the Fortran code:

1. Elevations: QAPxx_MOD.f90 modified to add new parameters to the qa files.
2. QAPG: changed to write scale factors to the file headers to facilitate comparison of the qa files written by L1a, Waveforms, and Elevations code with the files written by QAPG.

For the IDL code (QAPRead, QAPCompare):

1. Added the ability to read scaling factors from QAP file header.
2. Changed QAPCompare to
- Use the scaling factors when comparing the primary and alternate QA files
- Generate valid automatic qa metadata parameters for elevation products
- Generate valid operational qa for the products for which this is currently possible -- GLA01, 04, 05, 06, 12-15.
3. Updated elevation qa summary data structure.
Parameter QAP06,12,14 QAP13 QAP15
NShotsInFile x x x
NInvalidElevation x x x
NInvalIdreflectivity x x x
NInvalidRoughness x x
NInvalidSlope x
4. Included minor cleanup and documentation changes.
5. Changed default QAP file Version. VERSION=4.1: Because of changes to the GLA01, 6, and 12-15 QAP files, the Version number in the control files should be changed to 4.1 after the associated Mantis items are merged.

0001386: QAP01 changes for Metadata

Modifications for GLA01 metadata calculations.

Modules changed:

QAP01_mod.f90:
- i_NumMissingRange and i_NumNoData added to qap01 summary data structure and computed.

/glas/vob/src/qapg/qapg_elev_mod.f90: Added 2 elements to GLA01 SumParmIndices.

/glas/vob/idl/qa_browse/compare/qapc_metadata.pro: Correct component name: change FailureLevel.GLA013 to FailureLevel.GLA13

/glas/vob/idl/qa_browse/util/qap01V2_datastruct.pro: Added component numbers to the comment filed for each component of both structures.

0001273; No valid QA for GLA08-11

Atmospheres QA for products GLA08-GLA11 have been repaired so that acceptable data is now always being output. QAP data output is a single summary record. Previous outputs were usually missing, since they were only output when interval times happened to match even values of 20 seconds.

0001267: GLA09 Aerosol / Cloud Discrimination and Layer Detection

Added a latitudinal dependence to the cloud/aerosol discrimination. Prior versions had trouble in the high latitudes where cirrus-like clouds extend to the surface. The misidentification of these clouds as aerosol is now corrected.

Added a transmission correction to the cloud aerosol discrimination routine. When there are multiple layers present, the signal strength of the lower layers is diminished due to the attenuation of the layers above. The weak signal of the lower layer often looks like aerosol. This transmission correction will help with the correct classification of multiple layers.

Added code which checks for horizontal continuity of aerosol layers. This is used to reduce the occurrence of false positives

Added a rudimentary cloud/aerosol discrimination for the 1064 layer detection. The low resolution cloud use flag is now given a value of 3 when the layer was detected using the 1064 channel and that layer is deemed aerosol. The use flag has the value of 2 if it was detected using the 1064 channel and it is thought to be cloud.

0000839: Release 12 GLA05 problems discovered in QA data
Fixed several GLA05 QA problems -

 - Corrected calculation of % of waveforms with no signal.
 - Corrected calculation of the histogram of the distance from wf centroid to
 center of last peak.
 - Invalids are no longer included in the histograms.
 - Changed min value for histograms of two standard deviations to zero.

 Modules affected:

 common_libs/math_lib/w_add2hst_mod.f90
 - Return bin number = 0 if value = invalid.

 qapg/qapg_elev_mod.f90
 - Corrected error that was telling the QA Browse program that the histogram
 of the number of initial peaks was not computed.

qapg/qapg_gla05_mod.f90

-

qapg/qapg_gla05_sum.f90
- % no sig, sat, etc are set to Invalid in the output record if there are
no bad data. This is because with initialization to 0, there is no
way to distinguish no bad data from no data. Changing initialization to
set them to invalid, and other code to test for this condition.
- Corrected limits and n elements for histogram of number of initial peaks.

waveforms/W_Assess/W_Assess_mod.f90
- Moved code that sets the along-track record start and stop times

waveforms/W_Common/QA_wf_mod.f90
- Changed lower limits for histograms of fit noise and peak locations
standard deviation to zero.

waveforms/W_CreQAStats/W_CreQAStats_mod.f90
- Do not write the along-track record if the times are zero.

waveforms/W_FunctionalFt/W_FunctionalFt_mod.f90
- Ignore invalids during data collection.
- Allow the histogram of distance between waveform centroid and center of
last peak to have negative values.
-    Added code to accumulate the composite histogram of number of final peaks.

Changed ANC07 Parameters:

anc07_01

        added GI_MIN_ANC32_RECS=2 : Minimum Number of ANC32 records

anc07_02

        added I_QA07_DUMP_TME = 16 : Quality Assurance dumping intervals

        added I_QA08_DUMP_TME = 16 : Quality Assurance dumping intervals

        added I_QA09_DUMP_TME = 16 : Quality Assurance dumping intervals

        added I_QA10_DUMP_TME = 16 : Quality Assurance dumping intervals

        added I_QA11_DUMP_TME = 16 : Quality Assurance dumping intervals

anc07_04

        added D_DPROX1 = 0.0d0 : fraction of peak sigma proximity to sigB or sigE
        allowed during fit

        added D_DPROX2 = 0.25d0: fraction of peak sigma proximity to sigB or sigE
        allowed during fit

        added I_KEEPALLPKS1 = 1 : 1=don't remove peaks if too small, too narrow, or
        too close.

added I_KEEPALLPKS2 = 0 : 1=don't remove peaks if too small, too narrow, or too close.

added I_ESTSW1 = 0 : Switch used during fit; 0=Recompute peak amplitudes by subtracting the contribution from all larger peaks, 1=Do not recompute amplitudes

added I_ESTSW2 = 1 : Switch used during fit; 0=Recompute peak amplitudes by subtracting the contribution from all larger peaks, 1=Do not recompute amplitudes

anc07_05

added GI_LIM_GAINSHIFT_RNG=4500000 : GainShift Constant

added GD_LIM_GAINSHIFT_SEC=0.03d0 : GainShift Constant

Changed Files:

```
./data/anc07_001_01_0000.dat
./data/anc07_001_01_0001.dat
./data/anc07_001_01_0002.dat
./data/anc07_001_01_0004.dat
./data/anc07_001_01_0005.dat
./data/anc45_001_01_0001.dat
./data/anc45_001_01_0002.dat
./data/anc45_001_01_0003.dat
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./data/anc45_001_01_0014.dat
./data/anc45_001_01_0015.dat
./idl/qa_browse/browse
./idl/qa_browse/browse/definebar.pro
./idl/qa_browse/browse/qab_alongtrackstatplot.pro
./idl/qa_browse/browse/qab_gndtrkmap.pro
./idl/qa_browse/browse/qab_mapspecs.pro
./idl/qa_browse/browse/qab_plotmap.pro
./idl/qa_browse/browse/qab_plotsetup.pro
./idl/qa_browse/browse/qab_plotstart.pro
./idl/qa_browse/browse/qab_tableline.pro
./idl/qa_browse/browse/qab_writeheadfoottoplot.pro
./idl/qa_browse/browse/qab01.pro
./idl/qa_browse/browse/qab01_lowerlevelplots.pro
./idl/qa_browse/browse/qab02_lowerlevelplots.pro
./idl/qa_browse/browse/qab04_barspage1.pro
./idl/qa_browse/browse/qab04_barspage2.pro
./idl/qa_browse/browse/qab05.pro
./idl/qa_browse/browse/qab05_groundtrackmaps.pro
./idl/qa_browse/browse/qab05_lowerlevelplots.pro
./idl/qa_browse/browse/qab05_plottable.pro
./idl/qa_browse/browse/qab05_writetabletoplot.pro
./idl/qa_browse/browse/qab06.pro
./idl/qa_browse/browse/qab06_lowerlevelplots.pro
./idl/qa_browse/browse/qab07.pro
./idl/qa_browse/browse/qab07_oldplot.pro
./idl/qa_browse/browse/qab07_plot.pro
./idl/qa_browse/browse/qab08.pro
./idl/qa_browse/browse/qab08_oldplot.pro
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./idl/qa_browse/browse/qab09.pro
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./idl/qa_browse/browse/qab09_plot.pro
./idl/qa_browse/browse/qab10.pro
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./idl/qa_browse/browse/qab10_plot.pro
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./idl/qa_browse/browse/qab11_oldplot.pro
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./idl/qa_browse/browse/qab13and15.pro
./idl/qa_browse/browse/qabatm_atplot.pro
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./idl/qa_browse/browse/qabatm_latlonticks.pro
./idl/qa_browse/browse/qabatm_pctvalid.pro
./idl/qa_browse/browse/qabatm_statplot.pro
./idl/qa_browse/browse/qabrowse.pro
./idl/qa_browse/browse/sample.txt
```

```
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./idl/qa_browse/compare/sample.txt
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./idl/qa_browse/util/atmstats__define.pro
./idl/qa_browse/util/colorbar__define.pro
./idl/qa_browse/util/colors.palm.tbl
./idl/qa_browse/util/compareqap.pro
./idl/qa_browse/util/isnum.pro
./idl/qa_browse/util/makecolortable.pro
./idl/qa_browse/util/qa_colors.pro
./idl/qa_browse/util/qa_exitcodes.pro
./idl/qa_browse/util/qab_cloud_colors.pro
./idl/qa_browse/util/qab_translatecomponentstatus.pro
./idl/qa_browse/util/qabatm_consts.pro
./idl/qa_browse/util/qacolors.tbl
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./idl/qa_browse/util/qap04_datastruct.pro
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./idl/qa_browse/util/qap10V2_datastruct.pro
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./idl/qa_browse/util/qap15V5_datastruct.pro
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./idl/qa_browse/util/removetrailingzeros.pro
./idl/qa_browse/util/strprint.pro
./idl/qa_browse/util/struct_diff.pro
./idl/qa_browse/util/struct_max.pro
./idl/qa_browse/util/vectortostruct.pro
./Makefile
./src/atm_lib
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./src/atmosphere/common/A_types_mod.f90
./src/atmosphere/layers/A_1s_1064_det_mod.f90
./src/atmosphere/layers/A_20s_1064_det_mod.f90
./src/atmosphere/layers/A_4s_1064_det_mod.f90
./src/atmosphere/layers/A_cld_det_mod.f90
./src/atmosphere/layers/A_cld_det_mod.f90
./src/atmosphere/layers/A_cld_lays_mod.f90
./src/atmosphere/layers/A_lays_1064_mod.f90
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./src/atmosphere/QA/QAP09_mod.f90
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./src/common_libs/anc_lib/anc07_wf_mod.f90
./src/common_libs/anc_lib/anc08_pod_mod.f90
./src/common_libs/anc_lib/vers_anc_mod.f90
./src/common_libs/cntrl_lib/vers_cntrl_mod.f90
./src/common_libs/err_lib/vers_err_mod.f90
./src/common_libs/exec_lib/ReadAnc_mod.f90
./src/common_libs/exec_lib/vers_exec_mod.f90
./src/common_libs/file_lib/vers_file_mod.f90
./src/common_libs/geo_lib/vers_geo_mod.f90
./src/common_libs/Makefile
./src/common_libs/math_lib/vers_math_mod.f90
./src/common_libs/math_lib/w_add2hst_mod.f90
./src/common_libs/platform_lib/const_atm_mod.f90
./src/common_libs/platform_lib/const_elev_mod.f90
./src/common_libs/platform_lib/const_glob_mod.f90
./src/common_libs/platform_lib/const_l1a_mod.f90
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./src/common_libs/prod_lib/GLA01_mod.f90
./src/common_libs/prod_lib/GLA01_print_mod.f90
./src/common_libs/prod_lib/GLA01_prod_mod.f90
./src/common_libs/prod_lib/GLA01_scal_mod.f90
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./src/common_libs/prod_lib/GLA05_prod_mod.f90
./src/common_libs/prod_lib/GLA05_scal_mod.f90
./src/common_libs/prod_lib/GLA07_alg_mod.f90
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./src/common_libs/prod_lib/GLA07_prod_mod.f90
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./src/elev_lib/Makefile
./src/elev_lib/vers_elev_mod.f90
./src/elevations
./src/elevations/anc09_pad_mod.f90
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./src/glas_alt/WFMgr_mod.f90
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./src/l1a_lib/vers_l1a_mod.f90
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./src/prod_util/scf_prod_readers/Makefile
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./src/qapg/qapg_generate_mod.f90
./src/qapg/qapg_gla05_at.f90
./src/qapg/qapg_gla05_mod.f90
./src/qapg/qapg_gla05_sum.f90
./src/qapg/qapg_histogram_mod.f90
./src/qapg/qapg_scalefactors_mod.f90
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./src/qapg/qapg_specialcases_mod.f90
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./src/qapg/V_read_control_mod.f90
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./src/waveforms/W_Common
./src/waveforms/W_Common/QA_wf_mod.f90
./src/waveforms/W_Common/W_LsqFit_mod.f90
./src/waveforms/W_CreQAStats/W_CreQAStats_mod.f90
./src/waveforms/W_FunctionalFt/W_FunctionalFt_mod.f90
./src/waveforms/W_MeanSDev/W_MeanSDev_mod.f90
./src/wf_lib/vers_wf_mod.f90
```

LEVEL 2 SEA ICE PRODUCT – GLA13

The sea-ice algorithm is designed to provide estimates of:

a. Average range to the surface of smooth or randomly rough ice or of open water within the footprint will be inferred from the time delay of the centroid of the best-fit Gaussian associated with the maximum amplitude peak in the return pulse. For sea ice, this elevation will be slightly above the local sea surface, and time series of such data might provide an indication of the temporal variability of sea-ice freeboard during the period of the mission if we also have information on temporal variability of sea-surface elevation in the same regions. For orbit tracks crossing open-water leads and polynas, is should be possible to estimate the freeboard of surrounding sea ice, giving an indication of sea-ice thickness (Wadhams et al, 1992), as proposed by Peacock et al, (1998) using satellite radar-altimeter data.

Products:

i_elev: sea ice surface elevation, which is the "surface elevation wrt ellipsoid at the spot location determined by range using the sea ice specific fitting procedure after atmospheric delays and tides have been applied". Computed from the reference range to the surface by applying the correction of i_siRngOff defined as "range offset to be added to i_refRng to calculate the range using the algorithm deemed appropriate for sea ice".

b. Average range to all surfaces in the footprint will be inferred from the time delay of the centroid of return waveform above noise threshold. For smooth and randomly rough sea ice and for open water, this should be almost identical to (a). The difference between (a) and (b) gives an indication of whether a significant fraction of the footprint is occupied by a large ice ridge or an iceberg, causing an asymmetric, non-Gaussian return waveform.

Products:

i_AvgElev: Average elevation of all surfaces in the footprint from the centroid of the raw waveform with all corrections applied. Computed from the reference range to the surface by applying the correction of i_cntRngOff defined as "offset to be added to i_refRng to give the range in distance to the location of the centroid of the received echo from signal begin through signal end defined by the standard parameters."

c. Sea-ice surface roughness estimates will be obtained from the RMS width of the whole return pulse as well as from the RMS width of best-fit Gaussian associated with its maximum peak. The first is a measure of the total surface elevation variation, and the latter a measure of the roughness of the smooth ice of or open ocean surface within the footprint.

Products:

I_RufSeaIce: The RMS width of the whole return should be computed as follows:

$$rms\_width = \left[\frac{\sum_{i=I_1}^{I_2} A(i) \cdot i^2}{\sum_{i=I_1}^{I_2} A(i)} - \frac{\sum_{i=I_1}^{I_2} i \cdot A(i)}{\sum_{i=I_1}^{I_2} A(i)} \right]^{1/2} \cdot \delta t$$

where A(i) contains the waveform as it is quantized in both time and voltage and t   is the digitizing interval. The index runs from the first threshold crossing to the last threshold crossing. The rms_width is given in sec and it should be converted into distance units using

(9). The idea of computing the rms_width this way is adapted from the waveform simulator (page 36). The width is actually equivalent with the standard deviation of the population that has a histogram of the ICESat waveform.

i_SiRufLstPk: The surface roughness over the footprint calculated empirically from the transmitted and received waveforms using the RMS width of the maximum peak.

I_AvgRuf is not defined.

d. Range to the highest surface in the footprint will be inferred from the time delay of the centroid of the best-fit Gaussian associated with the first peak in the return waveform. This indicates the highest large roughness element, or surface of iceberg, floating glacier tongue, or land within the footprint.

Products:

i_BergElev: For waveforms with more than 1 peak, 'iceberg' elevation is calculated using the difference between the range offset of the maximum amplitude peak and the range offset of the first peak. Computations are made after atmospheric and tide corrections have been applied. The elevation computed is relative to the ellipsoid. Users should be wary that this parameter is computed for all multiple-peak GLA13 records, even if the elevation is too high to be sea-ice.

e. Average reflectivity within the footprint will be obtained from the total energy in the return pulse, taking account of the transmitted energy, height of spacecraft, receiver characteristics etc.

Products:

i_reflctUncorr:

The reflectance (not corrected for atmospheric effects) is calculated as the ratio of the received energy after it has been scaled for range, and the transmitted energy. The corrected reflectance may be calculated from this uncorrected reflectance by dividing by $e^{-2(tc+ta+tm)}$, where tc is the cloud (column) integrated optical depth, ta is the aerosol (column) integrated optical depth, and tm is the molecular optical depth. This uses all signal between signal begin and signal end.